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Apparatus and method for mass transfer involving biological/pharmaceutical media.

A mass transfer apparatus and method is based upon use of a mass transfer chamber (12), such as a hollow fiber membrane bioreactor, with means to change the directional flow (16) therethrough for enhancement of the mass transfer operation. The invention has particular utility in cell growth systems, where the periodic reversal of flow direction of a nutrient stream passed through the bioreactor equalizes dispersion of cell growth through the bioreactor and enhances the transport of metabolic waste from the cells being grown.

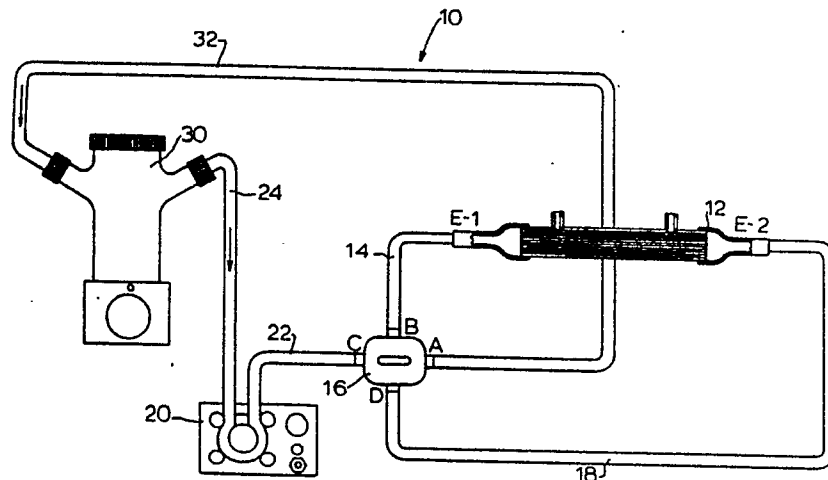


FIG. 1



DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
X	PATENT ABSTRACTS OF JAPAN vol. 10, no. 262 (C-371)(2318), 6th September 1986; JP - A - 61 88872 (SNOW BRAND MILK PROD CO LTD) 07-05-86 * abstract *	1-4,7- 31	C 12 M 1/12 C 12 M 3/00 B 01 D 13/00 A 61 M 1/18
X	PATENT ABSTRACTS OF JAPAN vol. 7, no. 139 (C-171)(1284), 17th June 83; & JP - A - 58 51905 (ASAHI KASEI KOGYO K.K.) 26-03-83 * abstract *	1	
A	WO-A-8 602 379 (ENDOTRONICS INC.) * claims 1,12; figures 1-5 *	1,19,31	
A	WO-A-8 401 959 (UNIVERSITY OF CALIFORNIA) * claims 1,7,10; figure 2 *	1,19,31	
A	US-A-3 697 418 (A.M. JOHNSON) * claims 1,6; figure 2 *	1,19	
A,P	EP-A-0 246 065 (CELANESE CORPORATION) * claims 1,2,6,15,16; figure 1 *	1,19	TECHNICAL FIELDS SEARCHED (Int. Cl.4)
A	BIOTECHNOLOGY & BIOENGINEERING no. 5, 28th May, pages 646-658, New York, US; G.L. ALTSHULER et al.: "Continuous Hybridoma Growth and Monoclonal Antibody Production in Hollow Fiber Reactors-Separators." * figure 2 *	1,19,31	B 01 D 13/00 B 01 D 13/01 C 12 M 1/12 C 12 M 3/00 C 12 N 1/00 A 61 M 1/18
The present search report has been drawn up for all claims			
Place of search BERLIN		Date of completion of the search 17-03-1989	Examiner CORDERO ALVAREZ M.
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	